Better Buildings Residential Network Peer Exchange Call Series: *Car Talk: Electric Vehicles and Residential Energy Efficiency*

June 22, 2017

Call Slides and Discussion Summary

Agenda

- Agenda Review and Ground Rules
- Opening Poll
- Brief Residential Network Overview
- Updates from the Home Improvement Catalyst Initiative—Steve Dunn, Project Manager, Building Technologies Office, U.S. Department of Energy
- Featured Speakers
  - **Tim Sasseen**, Principal Advisor, Distributed Generation, Center for Sustainable Energy *(Network Member)*
  - **Kapil Kulkarni**, Marketing Associate, City of Burbank (CA)
- Discussion
  - What experiences do you have with integrating EVs and residential energy efficiency?
  - What challenges and opportunities do you see for the nexus between electric vehicles and residential energy efficiency?
  - Other questions/issues/lessons learned?
- Announcements and Closing Poll

Better Buildings Residential Network

Better Buildings Residential Network: Connects energy efficiency programs and partners to share best practices and learn from one another to increase the number of homes that are energy efficient.

Membership: Open to organizations committed to accelerating the pace of home energy upgrades.

Benefits:

- Peer Exchange Calls 4x/month
- Tools, templates, & resources
- Recognition in media, materials
- Speaking opportunities
- Updates on latest trends
- Voluntary member initiatives
- Residential Program Solution Center guided tours

Commitment: Members only need to provide their organization's number of residential energy upgrades per year.

For more information or to join, email bbresidentialnetwork@ee.doe.gov, *or go to* energy.gov/eere/bbrn *and click Join*

Best Practices: Center for Sustainable Energy

U.S. DEPARTMENT OF ENERGY

EV Grid Services

or Value Stacking Your Car

Center for Sustainable Energy®

Overview

- Increasing EV storage capacities and decreasing costs motivate EV grid services as additional value stream
- Once vehicle to grid (V2G) technical and regulatory efforts are successful,
  - How should EV's interact with the grid?
  - How can optimal interactions for the customer and the grid be motivated?

EV State of Charge: Spark vs. Bolt

80 Mile Range
21kWh Battery

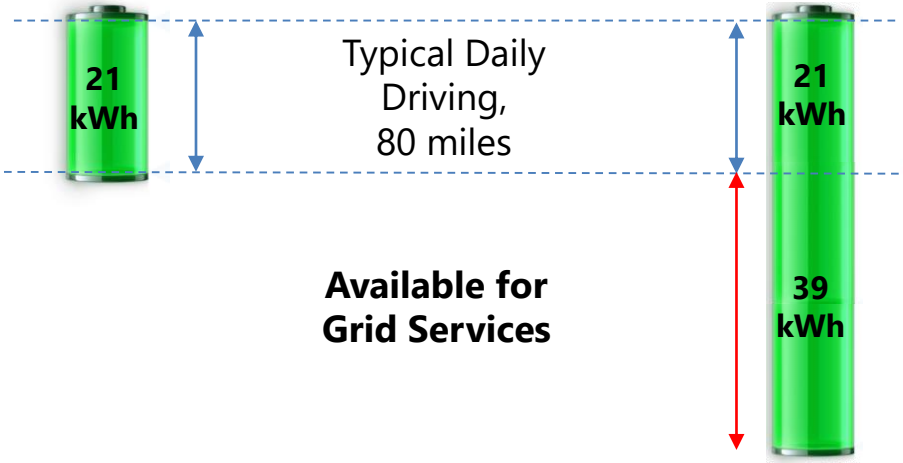
Range Anxiety Has Lead to Portable Power Plants

Next Generation EV's will likely have storage to spare on most days

238 Mile Range
60kWh Battery

SPARK

CHEVROLET



Available for Grid Services

BOLT

CHEVROLET

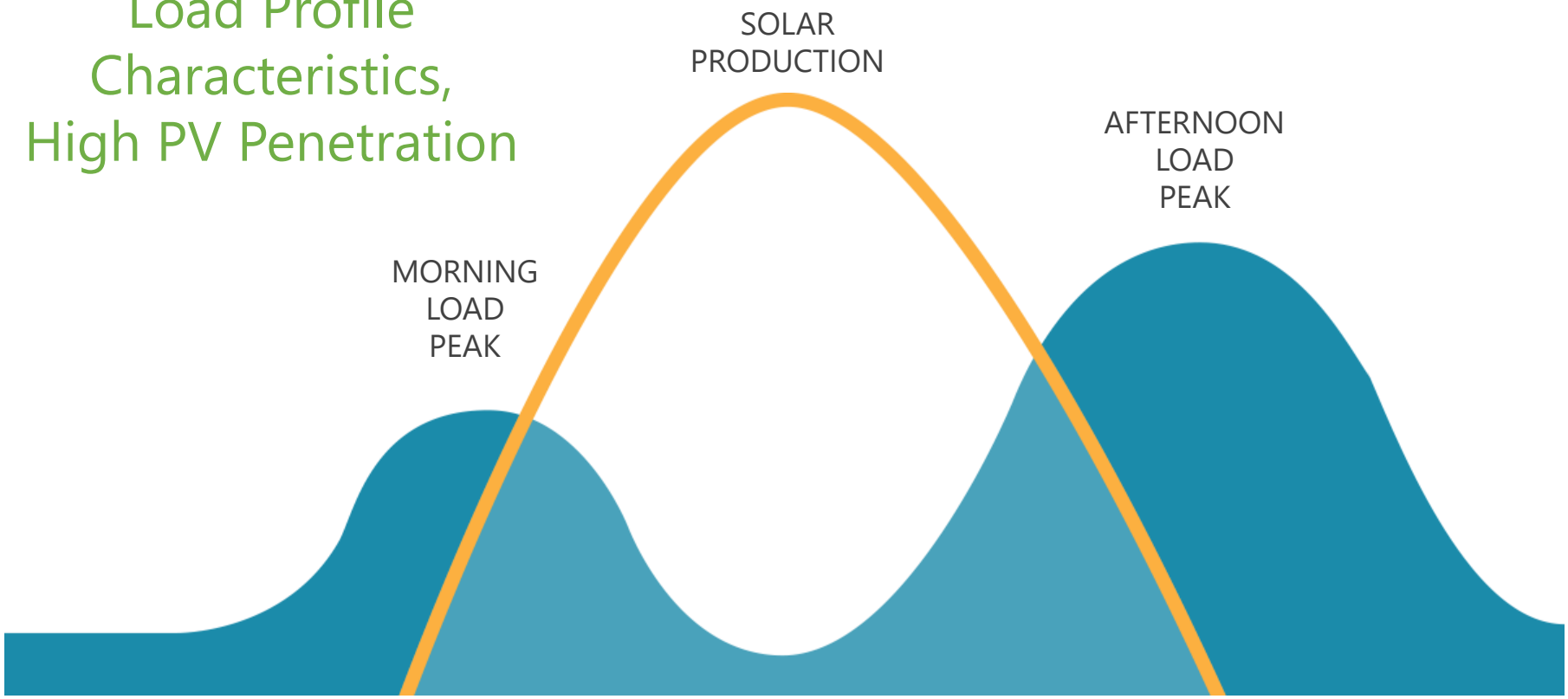
Center for Sustainable Energy®

EV's as an EE Choice

GHG & EMISSIONS	↓	↓	↓
TOTAL ENERGY CONSUMPTION	↓	↓	↑ ↓
UTILITY INFRASTRUCTURE	↑ ↓	↓	↑ ⇩
RETAIL RATES	↑	↑	↓

Solar + Storage: An EV Story

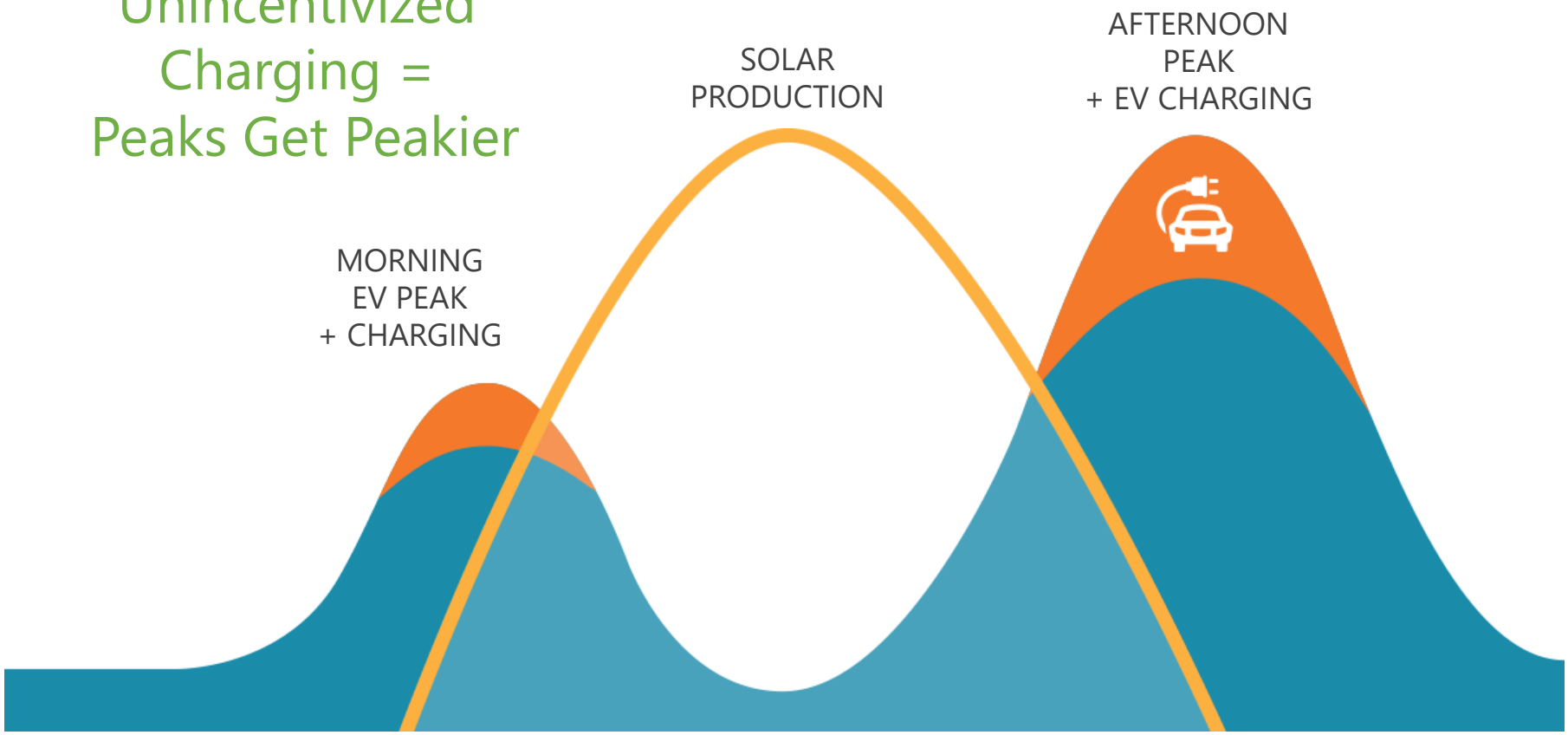
Typical Residential Load Profile Characteristics, High PV Penetration



Center for Sustainable Energy®

Book-end EV Charging

Unincentivized Charging = Peaks Get Peakier



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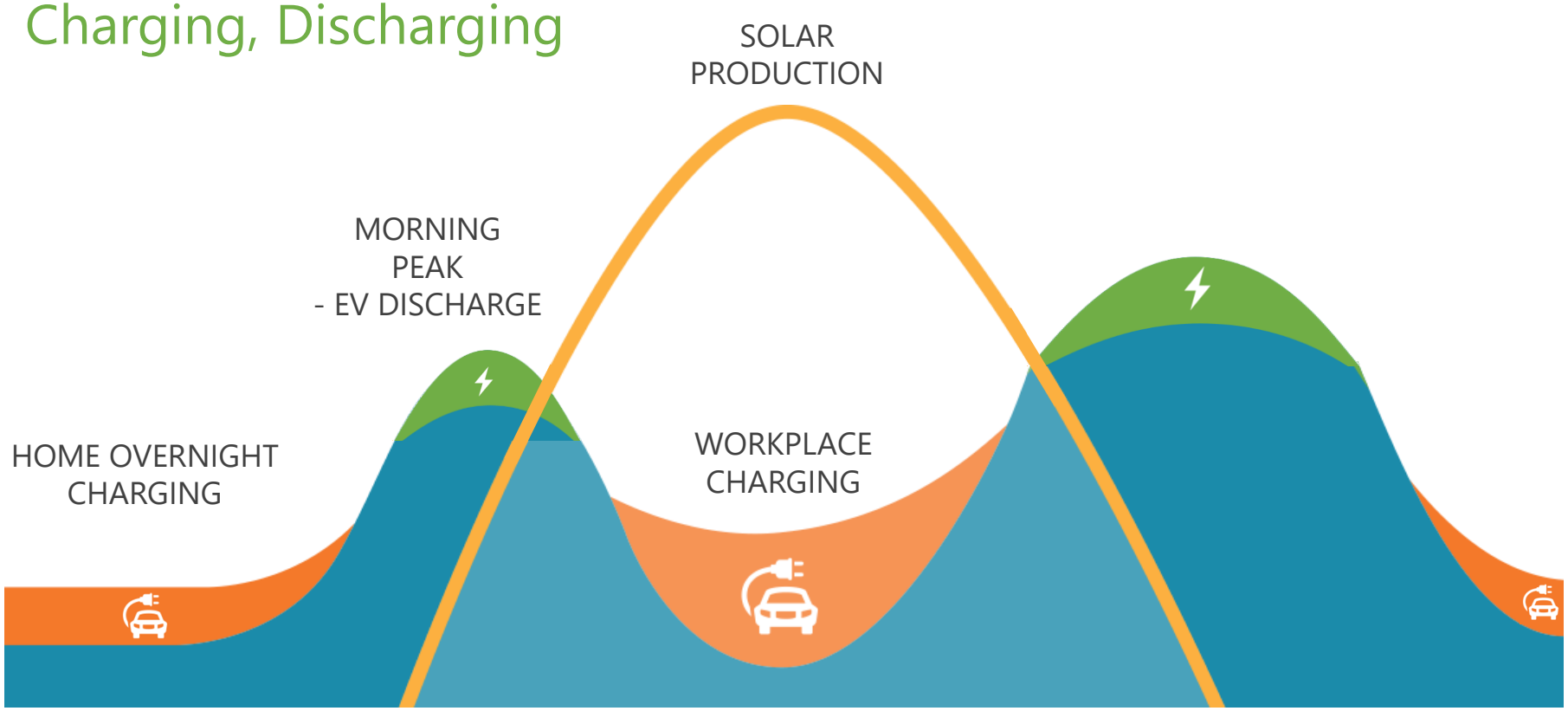
Peak Reduction EV Charging

Grid Incentivized Charging, Discharging



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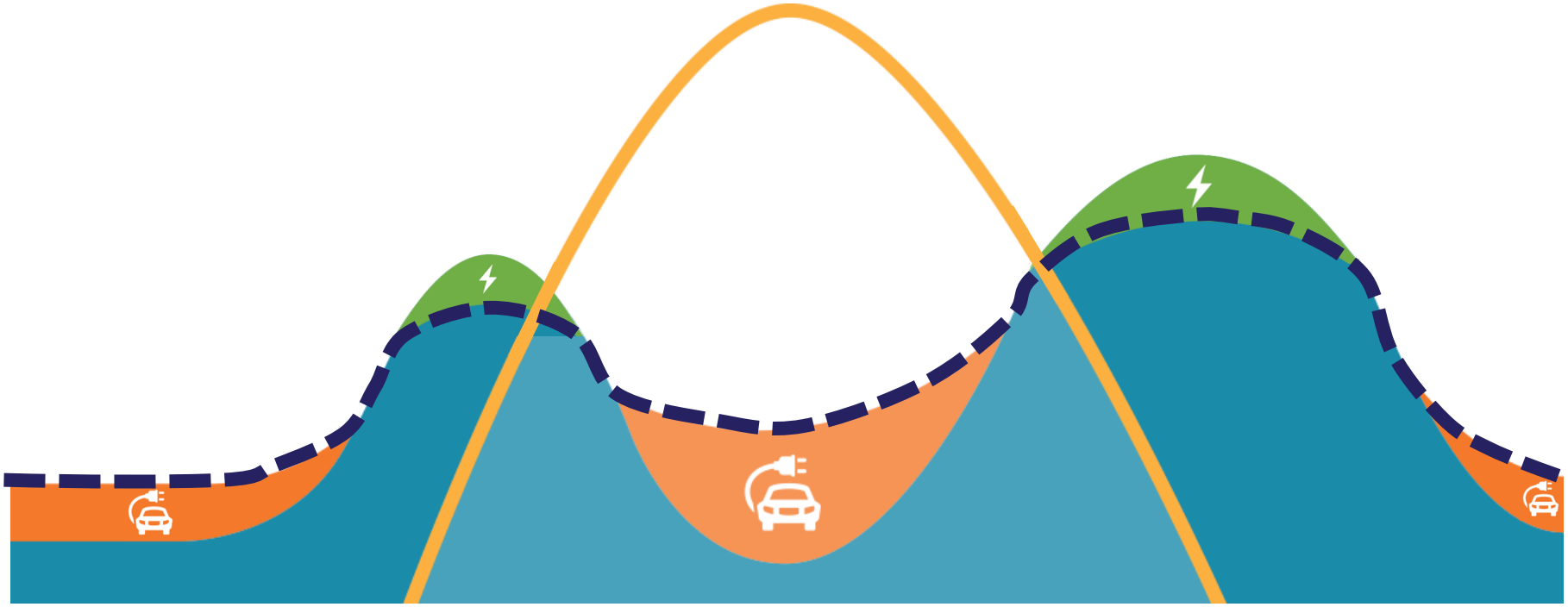
Load Profile- Peak EV Charging

Flat Load Profile = Lower Peak Generation,
Reduced T&D Congestion



But How Do You Get Enough EV's Charging this Way to Make a Difference???

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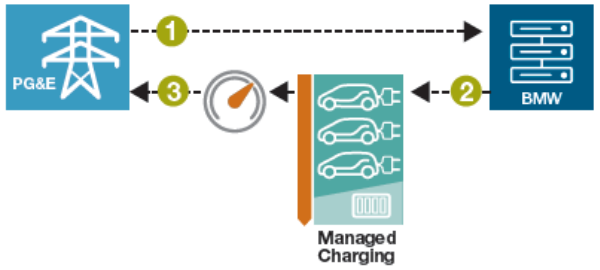
Affecting Behavior – One Centralized Approach

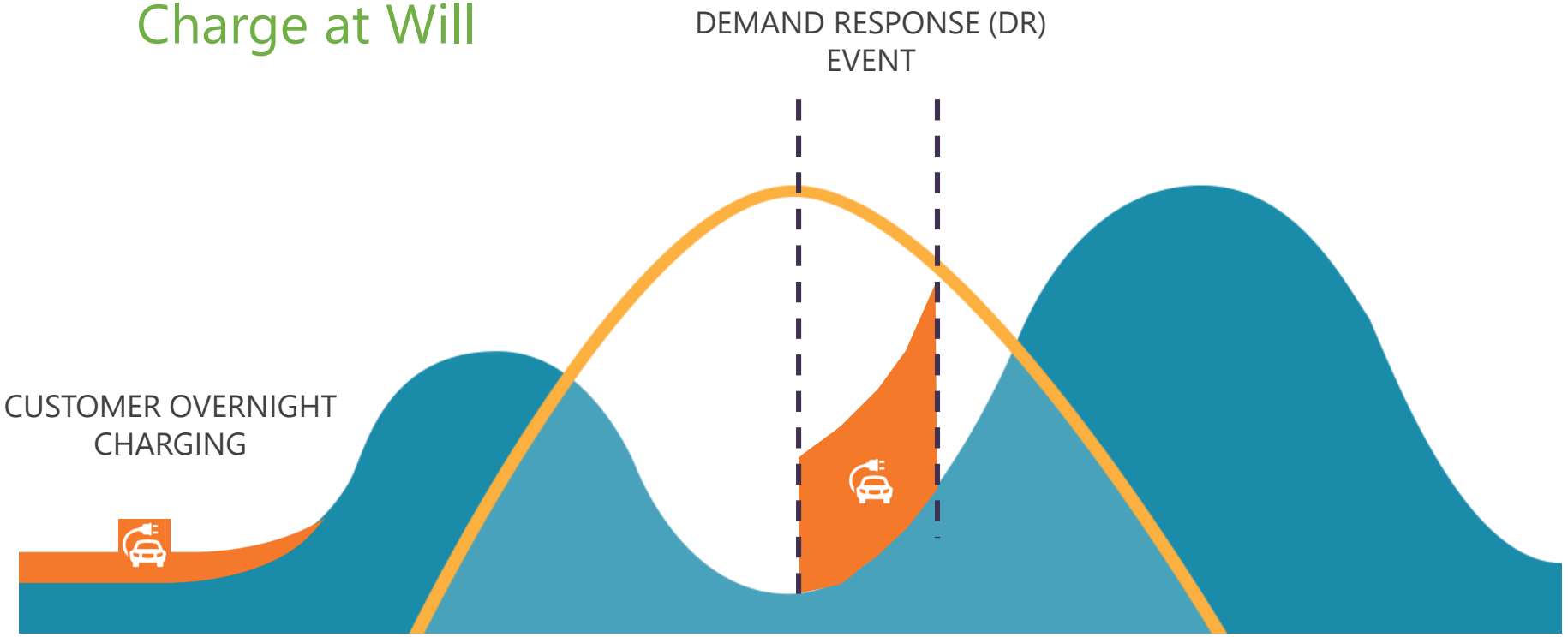
- A fleet of EV charging/discharging is coordinated (aggregated) as a single controllable load by a 3rd party
- The load is bid into the wholesale market as a demand resource (DR) to provide additional energy (day ahead market) or power capacity (real time market)
- Example: PG&E/BMW ChargeForward project
  - 100 vehicles for 100kW, 1hr DR resource*



* BMW, PG&E Report, "BMW i ChargeForward: PG&E's Electric Vehicle Smart Charging Pilot

DR Program Participation

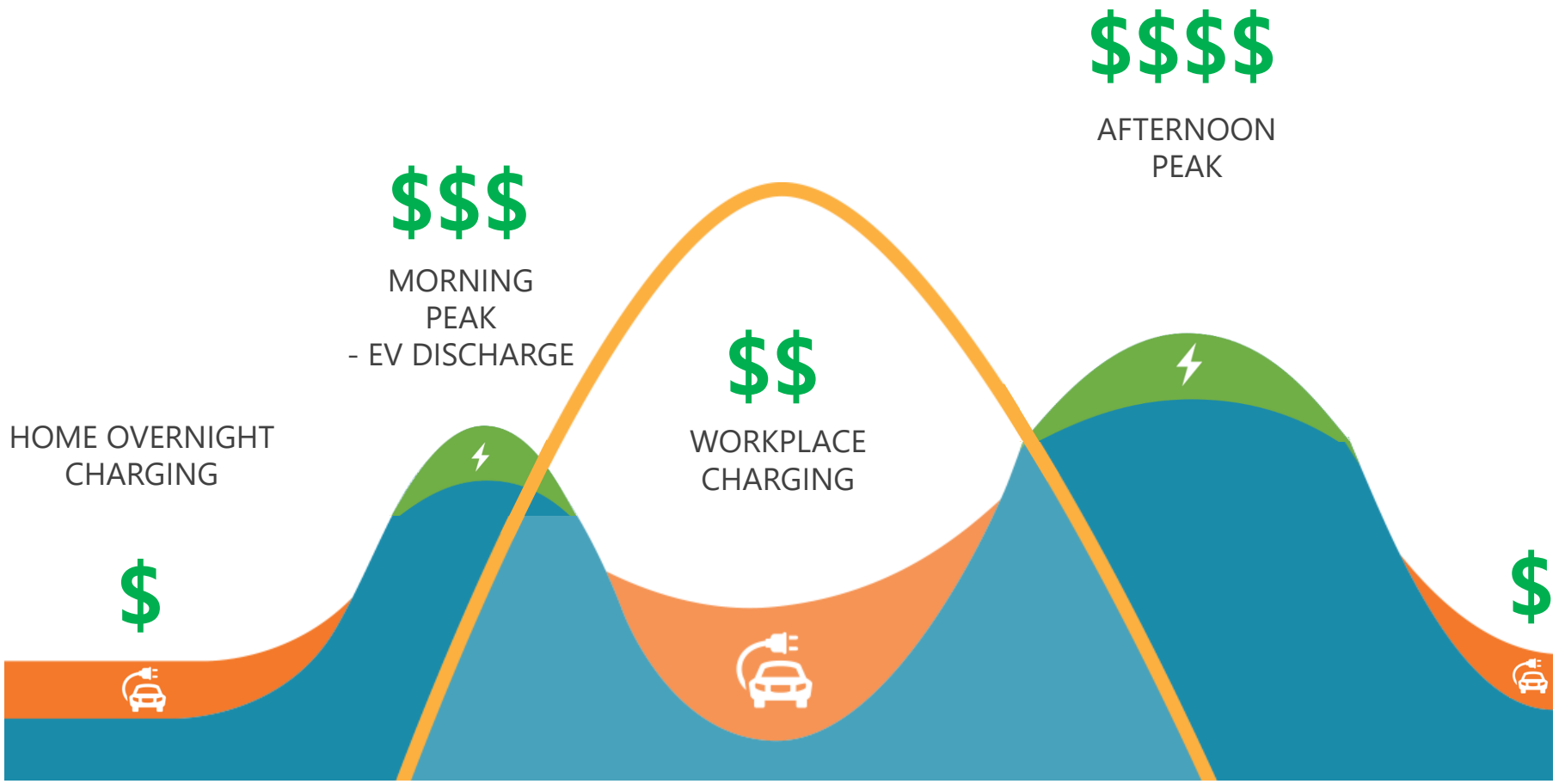
EV Owner Opts In to Allow Aggregator to Charge at Will



Affecting Behavior – A Price Signal Approach

- Market prices for electricity motivate charging when generation is excessive, and discharge when loads are high
  - TOU rate structures
  - Real Time Energy Market (future): Market prices for electricity are shared by all interconnected devices (e.g. Blockchain)
- EV owners allocate an unneeded fraction of car battery for grid services
- Excess solar production charges EV's in the day, and grid charges EV's at night when prices are cheap
- EV discharge automatically occurs when price is high = peak grid load time
- The Future…?

Market Price Signal Charge Control



Assumes Unrestricted Bi-Directional Power Flow (V2G),
kWh Prices Set By Rates or Real Time Market to Incentivize Charging Behavior

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Additional Grid Services & Costs

- Backup Power
  - 60kWh battery can power a typical home through the night on reduced load (= 4 Tesla Powerwalls)
- Microgrid Support
  - Medium and heavy duty vehicles (e.g. 100kWh) provide mobile power sources, for multiple buildings with grid disconnect/reconnect facilities
    - e.g. Ten 100kWh delivery trucks = 1MWh, or four hours of storage from a 250kW PV array

BUT - lifetime degradation of EV batteries must have a compensation mechanism as well.

- One approach is kWh billing from automakers for batteries, rather than up front purchase.
    - e.g. $125/kWh, 10,000 cycles = $0.0125/kWh

Our Mission:

Accelerate the transition to a sustainable world powered by clean energy

Center for Sustainable Energy®

Presentation Highlights: Center for Sustainable Energy

- **Electric vehicles (EVs) have a great potential to be used as an energy grid resource:**
  - **Centralized approach** through aggregated EV charging and demand response. The PG&E and BMW Charge Forward Project piloted this approach.
  - **Price signal approach** through time-of-use rate structures or real-time market prices.
- **With the current increased EV battery capacity**, only ~1/3 is used for commuting, leaving the rest available for other use.
- **EV charging at low loads periods** (e.g. nighttime and mid-day) improves grid resiliency and lowers peak generation costs.
- **Residential battery storage** is being increasingly installed, even if cost-effective compensation programs are currently limited.
- **Flexibility in EVs and battery storage offerings** is needed based on customer needs.

Best Practices: City of Burbank

U.S. DEPARTMENT OF ENERGY

BWP EV Charging Program

Better Buildings Residential
Network Peer Exchange

June 22, 2017

CITY OF BURBANK
Water and Power
since 1913
Always There for You!

EV Charging Plan

01 Introduction
BWP overview

02 Achievements
Public chargers, TOU rates, rebates

03 Incentives
Rebates and rates

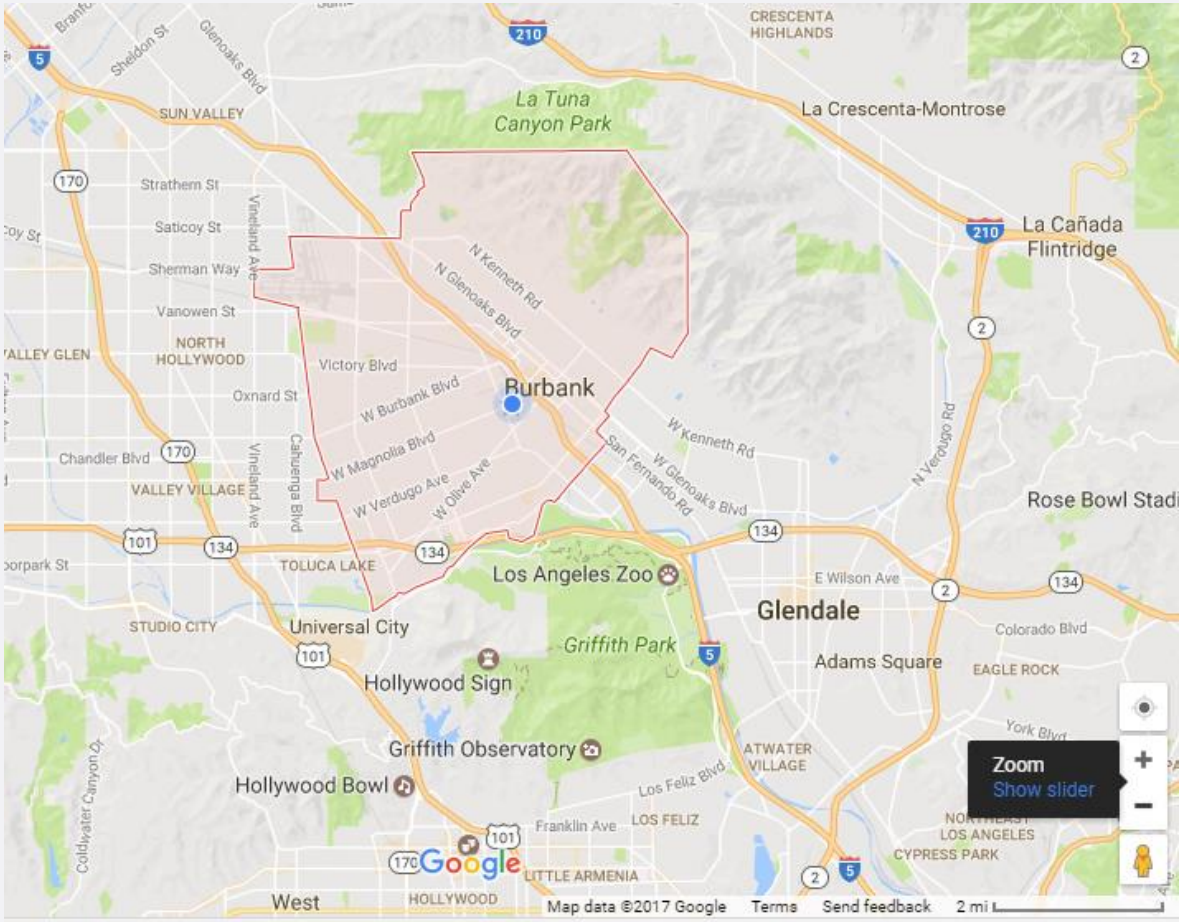
04 Sectors
Specific plans

05 Marketing
Events and information

06 Next steps

Introduction
Burbank Profile

- 12 miles NW of downtown LA
- 105,000 residents
- 17 square miles
- Media Capital of the World!



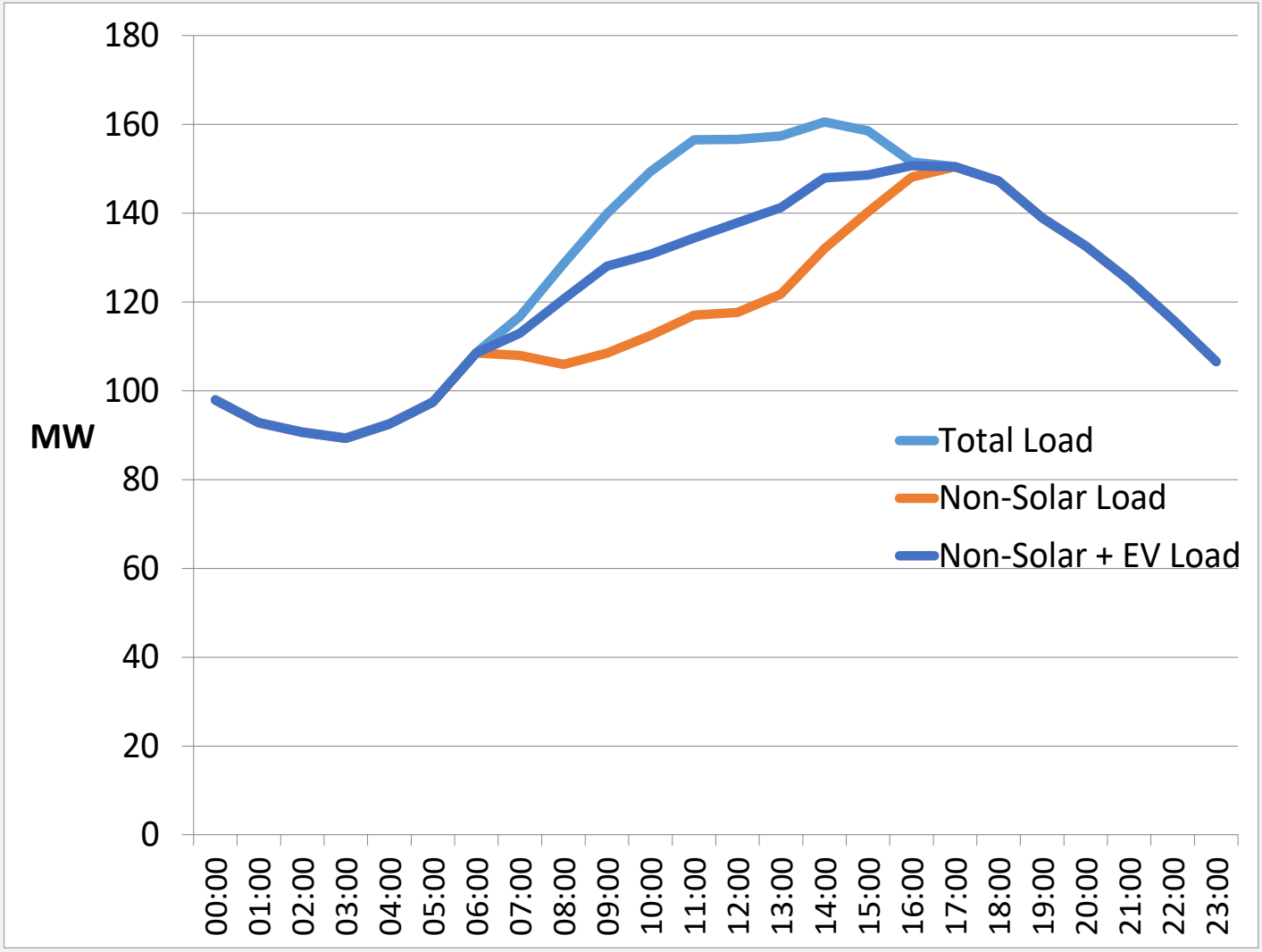
Introduction
BWP Profile

BWP's Electric Load

45,071	5,534	1,051	95	41
Residential	Small Commercial	Medium Commercial	Large Commercial	Extra Large Commercial
24.6% of Load	8.7% of Load	18.5% of Load	18.6% of Load	26.2% of Load

Street lighting charges and temporary power construction projects comprise the remaining 3.4%.

Introduction
BWP Daily Load Profile



Introduction
Market changes

Introduction
EV Charging Program Goals

- Balance the grid
- Enhance customer service
- Reduce range anxiety
- Promote clean technologies

- 11 Parking Lot Chargers
- 16 Curbside Chargers
- Airport Chargers
- DC Fast Charger
- Level 2 Rebates

Incentives
Rebates

CITY OF BURBANK Water and Power Since 1913

Always There for You!

EV CHARGER REBATE APPLICATION

Up to $500 for Residential | Up to $1,000 for Commercial

BurbankWaterAndPower.com | BWP Conservation (818) 238 - 3730 | BWPConservation@burbankca.gov

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Receive a REBATE for your Level 2 EV Charger!

First and Last Name -or- Business Name (Please Print):

BWP Account Number:

☐ Single Family Home
☐ Multi-Family
☐ Multi-Family House
☐ Commercial

Installation Address:

City: State: Zip:

Email Address:

Telephone Number: ( )

Incentives
Rates

	11pm-8am	8am-4pm	4pm-7pm	7pm-11pm
Residential	$0.08	$0.17	$0.25	$0.17
Commercial	$0.11	$0.13	$0.21	$0.13
Public - Level 2	$0.18	$0.18	$0.31	$0.18
Public - DC	$0.29	$0.29	$0.51	$0.29

The following chart is a heat map - green indicating lower prices and red indicating higher prices - of charger pricing, based on type of charger and time of day. The heat map can also be thought of as a daily load profile - where charging rates are lower when electricity supply exceeds demand.

Sector
Single Family

Characteristics

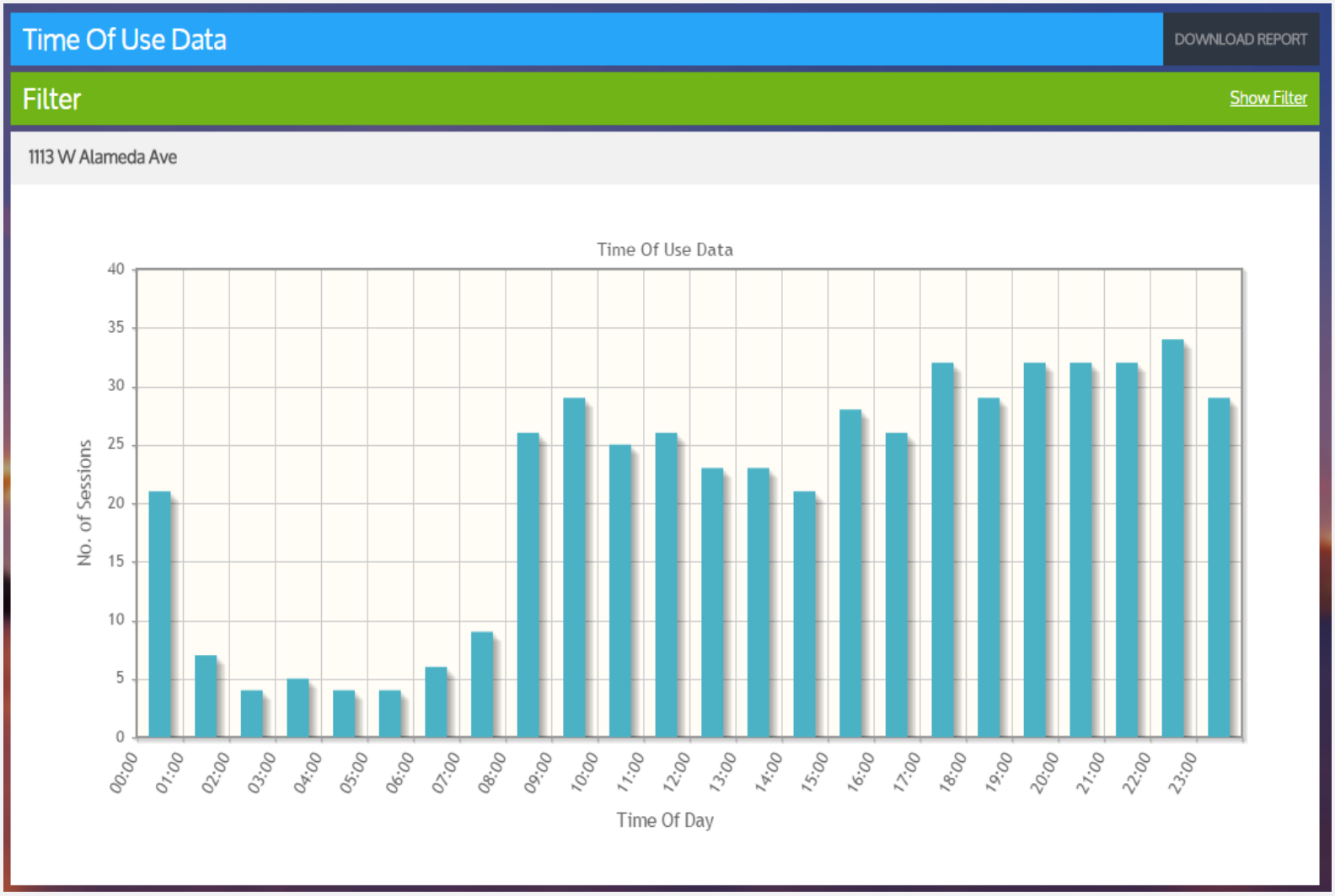
- Mostly self-sustaining market
- Relies on existing Level 1 outlets, or
- Level 2 charger rebates
- Works best with TOU rates

Sector
Multifamily

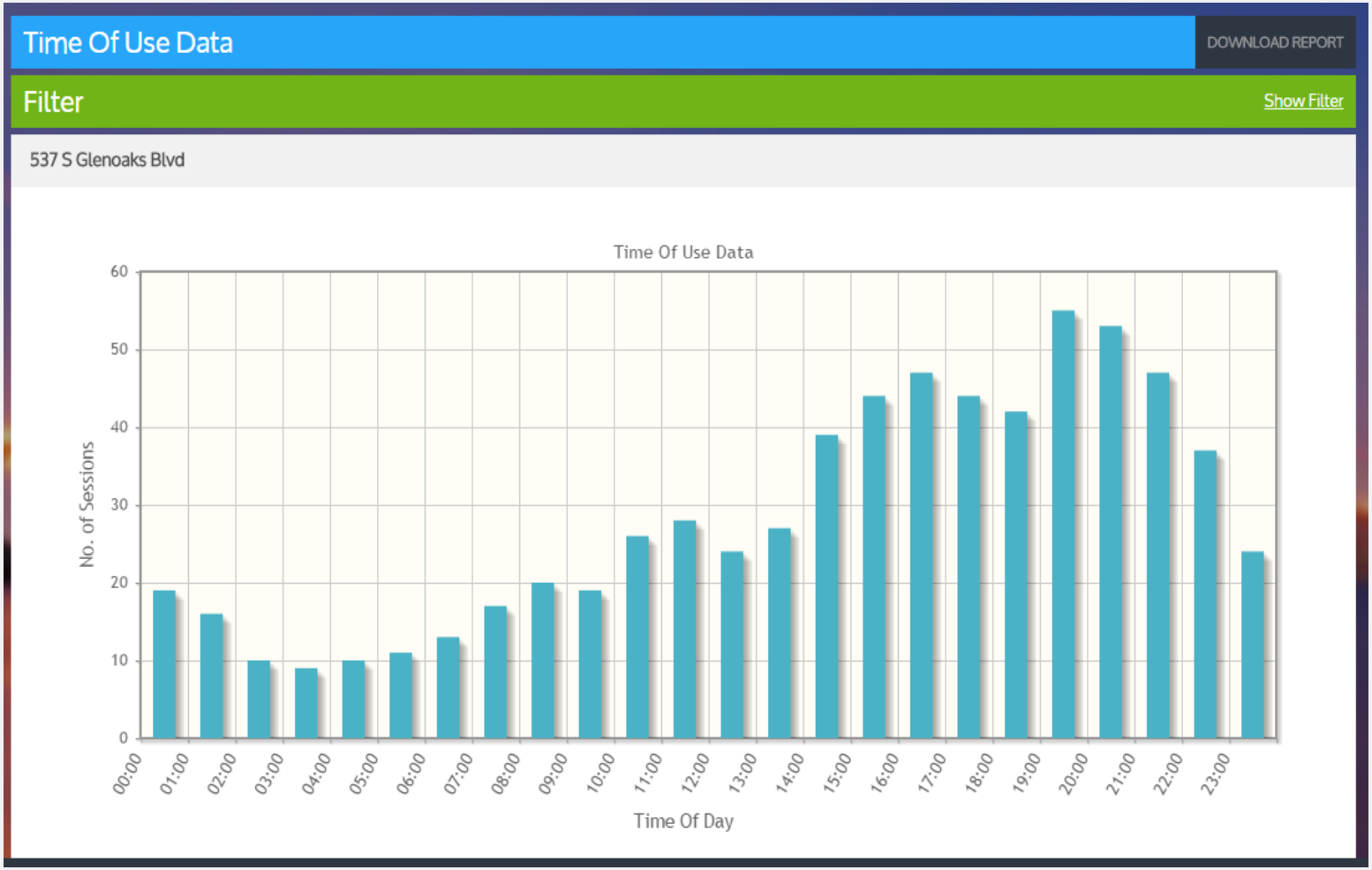
Characteristics

- Relies on either building owner, property manager, HOA, or resident to make a significant investment
- Charging mostly occurs at nighttime
- High reliance on workplace or public chargers

Commercial Public Charger
Number of Sessions by Time of Day



Multifamily Public Charger
Number of Sessions by Time of Day



EV Charging
Marketing

Ride and Drive Events

EV Information

BWP
Next Steps

EV Charging Program Plan

- Survey of infrastructure by sector
- Research into incentives, including rebates and rates
- Increase marketing efforts
- Third-party innovations

Presentation Highlights: City of Burbank

- **Key incentives offered by the City of Burbank to EV users:**
  - **Rebates** for customers installing a Level 2 (240V) EV charger
  - **Time of use rates** offering lower electric costs outside of peak times
- **People are more likely to buy EVs if their workplace has EV charging or if they have more opportunities to test them first.**
  - It takes more than one ride & drive event to get customers familiar with EVs.
- **Uptake of more EVs and optimized EV use is key**:
  - **Third parties** are now starting to provide services like EV charging sharing, to make it more economically attractive.
  - There is not resistance from auto dealers in promoting EVs.
  - **Events with auto dealers and EV drivers** make a powerful statement as most dealers are not educated in promoting EVs.

Discussion Highlights

- **Moving forward, EVs will have even more improved capabilities, making them more accessible.**
  - **DC fast chargers** (>240V) will become even more performant, but there'll always be a place on the market for Level 2 EV chargers as well.

- **EV car-sharing for low-income communities is currently piloted by some cities:**
  - **In Los Angeles** there's an EV car-sharing service for low-income. Public chargers are also available in all areas, including in low income communities.
  - **The City of Burbank** also applied for a grant to provide car-sharing for disadvantaged communities.

Residential Program Solution Center

Visit us!

rpsc.energy.gov

A living repository of resources for residential energy efficiency programs on these key components:

- Program Design & Customer Experience
- Marketing & Outreach
- Financing
- Contractor Engagement & Workforce Development
- Evaluation & Data Collection
- Market Position & Business Model

Related resources

- Report on the "*BMW i ChargeForward: PG&E's Electric Vehicle Smart Charging Pilot*"

- Previous related Peer Exchange Call summaries:
  - Driving Change in Residential Energy Efficiency: Electric Vehicles (301)
  - Are You Ready? Opportunities and Challenges of Home Energy Management Systems

Upcoming Seasonal Messaging Opportunities

Now is the time to start planning energy efficiency messaging campaigns for the fall season.

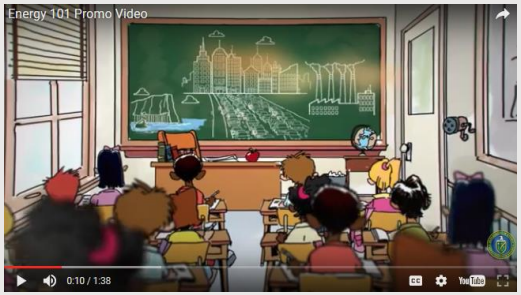
Here are some ideas to get you started. Please let us know what you come up with!

Sept 22 – Dec 20
Fall Season

End of August & September
Back to School

September 10
National Grandparents Day

The Residential Energy Services Network (RESNET)
Poster



U.S. Department of Energy
Article & Video: 5 Back-to-School Resources to Help You Learn About Energy

For related seasonal messaging opportunities, visit the Better Buildings Residential Network website:
Fall: Energy Saving Changes with the Season

Join the roofing systems innovation challenge

Join the roofing systems innovation challenge!

Register for the webinar: June 29, 2-3pm ET

Oak Ridge National Lab has partnered with GAF to host a technology challenge on roofing systems. The *call for innovation* is part of the online crowdsourcing site, JUMP, and aims to identify innovation solutions for ensuring energy efficient and durable low-slope roofing systems employing concrete decks.

The challenge is to develop new materials or installation methods that can be employed to modify a typical roofing system with a concrete deck so that the likelihood of having moisture related problems is significantly reduced. **The winner would receive $10K in cash sponsored by GAF and up to $20K in-kind support from ORNL technical scientist.**

Register for the challenge webinar on June 29 from 2-3pm ET to learn more. Ideas will be accepted through Sunday, August 27, 2017.

Peer Exchange Call Series

We hold one Peer Exchange call the first four Thursdays of each month from 1:00-2:30 pm ET

Calls cover a range of topics, including financing & revenue, data & evaluation, business partners, multifamily housing, and marketing & outreach for all stages of program development and implementation

Upcoming calls:

- August 3: Making The Grade: Innovative Approaches to Improving Quality
- August 10: Doing More with Less: Low Cost Program Strategies
- August 17: Back to School: Engaging Students in Energy Efficiency at Home and in the Classroom
- *August 31 & September 4: No calls*
- August 24: Making the Leap to the Multifamily Market
- September 14: Keeping Up with the Jones': Key Strategies for Behavior Change

Send call topic ideas to peerexchange@rossstrategic.com

See the Better Buildings Residential Network Program website to register

GET SOCIAL WITH US

Stay engaged and connected with the Better Buildings Residential Network and our partners from the residential and multifamily sectors!

Follow us to plug into the latest Better Buildings news and updates!

Share with us your top stories on how your organization is accelerating energy savings through efficiency upgrades, strategies, and investment!

Better Buildings Twitter with #BBResNet

Better Buildings LinkedIn

We can't wait to hear from you!

U.S. Department of Energy Solar Decathlon

Oct 5-15, 2017 DENVER

- 13 Collegiate teams compete in 10 contests
  - New for 2017: Innovation and Water
- Winning team best blends technology, market potential, design excellence with smart energy solar production and maximum energy and water efficiency.
- Large free public event – showcases best of clean energy technology
- Denver location: new, mixed use smart community on transit line near Denver International Airport
- Sponsorship Opportunities
- Info: www.SolarDecathlon.Gov

Solar Decathlon 2015 Teams in Irvine, Calif.
Credit: Thomas Kelsey/U.S. Department of Energy Solar Decathlon

Addenda: Attendee Information and Poll Results

U.S. DEPARTMENT OF ENERGY

Call Attendees: Network Members (1 of 2)

- Advanced Energy
- Alaska Housing Finance Corporation
- Austin Energy
- Boulder County
- Burbank Water and Power
- California Energy Commission
- Center for Energy and Environment (CEE)
- Center for Sustainable Energy
- City of Berkeley
- City of Fremont
- City of Kansas City
- Civic Works
- CLEAResult
- Columbia Water & Light
- Earth Advantage Institute
- Eden Housing
- Efficiency Maine
- Efficiency Nova Scotia
- Efficiency Vermont
- Elevate Energy
- Efficiency Maine

Call Attendees: Network Members (2 of 2)

- Energy Efficiency Specialists
- Enhabit
- GoodCents
- GRID Alternatives
- La Plata Electric Association
- National Association of State Energy Officials (NASEO)
- Northeast Energy Efficiency Partnerships (NEEP)
- Research Into Action, Inc.
- South Burlington Energy Committee
- The Environmental Center
- TRC Energy Services
- Vermont Energy Investment Corporation (VEIC)
- Wisconsin Energy Conservation Corporation (WECC)

Call Attendees: Non-Members (1 of 3)

- Acadia Center
- AeraDIGM, Inc.
- AjO
- Alliant Energy
- Bureau of Ocean Energy Management (BOEM)
- Business Council on Climate Change
- Cambridge Community Development Department
- California Institute of Environmental Design and Management (CIEDM)
- City of Asheville
- City of Burbank
- City of West Hollywood
- Clallam County
- Clark County
- Construction Services Group LLC
- Dow Corning
- E4TheFuture
- EfficiencyOne
- Energy Information Administration
- The Electric Cooperatives of South Carolina
- Energetics Inc.

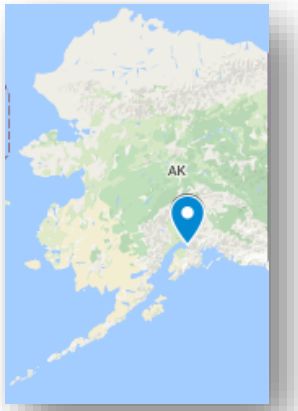
Call Attendees: Non-Members (2 of 3)

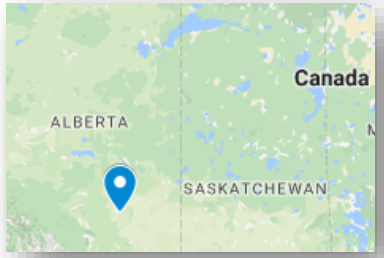
- Environmental and Energy Study Institute (EESI)
- Energy Solutions Professionals
- Flint Hills Renewable Energy & Efficiency Cooperative, Inc.
- Flathead Electric Cooperative
- Green Compass Sustainability
- HILCO Electric
- Holland Board of Public Works
- Holy Cross Energy
- Home Office Training & Technology
- ICF International
- Institut de recherche d'Hydro-Québec (IREQ)
- JEA
- Linden Hills Power & Light
- Local Government Commission
- AmeriCorps
- Massachusetts Department of Energy resources
- Mercy Housing Management Group

Call Attendees: Non-Members (3 of 3)

- Modular Lifestyles Inc.
- NANA Regional Corporation
- National Fuel Gas
- Off The Grid Renovations, LLC
- Opportunity Council
- People's Self Help Housing
- Power Integrations
- PV Blue
- Rappahannock Electric Cooperative
- Riverside Public Utilities
- Sierra Business Council
- Snohomish County
- Solar Habitats, LLC
- Stewards of Affordable Housing for Future (SAHF)
- SyrQul
- Third Rail Technologies
- University of Maryland
- University of North Carolina at Charlotte
- University of Minnesota
- City of Vernon
- West Virginia Division of Energy
- WECTEC LLC
- XLR8SUN Electric Car

Call Attendee Locations





Opening Poll #1

- Which of the following best describes your organization's experience with electric vehicles and residential energy efficiency?
  - Very experienced/familiar – ***35%***
  - Limited experience/familiarity – ***29%***
  - Some experience/familiarity – ***23%***
  - No experience/familiarity – ***12%***
  - Not applicable – ***0%***

Closing Poll

- After today's call, what will you do?
  - Seek out additional information on one or more of the ideas – ***69%***
  - Consider implementing one or more of the ideas discussed – ***22%***
  - Make no changes to your current approach – ***9%***
  - Other (please explain) – ***0%***